

DEVELOPMENT AND APPLICATION OF AUTOMATIC ACCIDENT RECORDING SYSTEM (In-car Accident Recorder) IN KOREA

Jae-Hoon Sul, Seong-Hee Cho

Center for Green Growth Research

The Korea Transport Institute

1160 Simindaero Ilsanseo-gu, Goyang, Korea

jhsul@koti.re.kr

ABSTRACT

This paper describes development and application of automatic accident recording system (AARS, in-car accident recorder) in Korea. First of all, the needs of automatic accident recording system are presented. There are many limitations in constructing traffic accidents. Therefore recording of driving information are necessary for finding accurate causes of accidents and follow-up measures. World trend in legislation of automatic accident recording system are summarized. Second, benefit of installing an in-car accident recorder is discussed. Both qualitative and quantitative effects are included. Benefit and cost regarding installing an in-car accident recorder are analyzed. Some cases investigated by an in-car accident recorder are described. Last, features of AARS in Korea are illustrated. This paper compares major specification of six Korean products.

1. INTRODUCTION

There are current limitations in reconstructing traffic accidents. In field examination, there are difficulties to keep an accident site and marks resulting from the accident on roads. Delay of field examination and transformation on distribution of debris are also the factors to make impossible to reconstruct traffic accidents. Vehicle damages from collision with other vehicles or pedestrian prevent reconstruction.

Reconstructing accidents are dependent on statements of people concerned, eyewitness evidence, and a driver's statement. Objectiveness and accuracy of constructing accidents are always controversial issue.

The table 1 shows rate of traffic accidents for OECD countries. 459.12 accidents per 100,000 people and 119.3 accidents per 10,000 vehicles happened in Korea. Korea ranks 27th in the number of person killed per 100,000 people and 10,000 vehicles.

Table 1. Rate of traffic accidents for OECD countries

Country	Population (1,000)	No. of vehicles (1,000)	No. of traffic accidents			Persons killed				Rate of fatalities
			Total	Per 100,000 persons	Per 10,000 vehicles	Total	Per 100,000 persons	Per 10,000 vehicles	Ranking	
Netherland	16,258	8,494	27,760	170.75	32.7	804	5.0	0.9	1	2.9
Japan	127,687	81,220	952,191	745.72	117.2	8,492	6.7	1.0	4	0.9
Switzerland	7,364	4,490	22,891	310.85	46.1	510	6.9	1.0	4	2.2
England (UK)	59,835	33,033	213,043	356.05	64.5	3,368	5.6	1.0	4	1.6
Germany	82,532	54,082	339,310	411.13	62.7	5,842	7.1	1.1	7	1.7
Australia	20,111	13,533	-	-	-	1,583	7.9	1.2	9	-
Italy	57,888	43,141	224,553	387.91	52.1	5,625	9.7	1.3	10	2.5
Canada	31,946	19,081	151,300	473.68	79.3	2,725	8.5	1.4	11	1.8
France	59,900	36,719	85,390	142.55	23.3	5,593	9.3	1.5	14	6.5
Spain	43,038	26,433	94,009	218.43	35.6	4,741	11.0	1.8	19	5.0
America	293,655	230,788a	1,900,000	647.02	85.1a	42,636	14.5	1.8	19	2.2
South Korea	48,082	18,960	220,755	459.12	119.3	6,563	13.7	3.5	27	3.0
OECD average	36,431	22,358	164,130	289.7	52.3	3,753	9.6	1.9	-	4.4

2. NEEDS FOR AARS

The number of registered vehicles is 16,428,177 and 220,755 accidents occurred in Korea. It means a person is injured every 90 second. Social costs of traffic accidents are 9 trillion Korean Won having 1.1% of GDP. The number of hit-and run accidents is 2,500 resulting in 353,000 fatalities.

Evidences for accidents are needed due to increase of accident disputes. AARS could prevent accidents resulting in decreasing damage (fatalities and properties).

Recording of driving information are necessary for finding accurate causes of accidents and follow-up measures. Therefore, U.S, Japan, EU, China and Korea are making a law and standard of AARS.

US DoT (Department of Transport) announced AARS standard in 2004. NHTSA (National Highway Traffic Safety Administration) recommended installing an in-car accident recorder in 2006. State of California (2003), Arkansas, Nevada, North Dakota (2004) made a law to mandatorily install AARS. A law requiring all vehicles to install an in-car accident recorder since 2009 was made in EU. In Japan, a taxi, bus, truck started installing in-car accident recorders because some kinds of vehicle must

install them. In China, all vehicles were required to install an in-car accident recorder before Beijing Olympic 2008. In Korea, the standard for making AARS was established in 2008. The law requiring all vehicles to install a digital tachometer is developing.

In Incheon Metropolitan City, all company taxis (5,300) installed in-car accident recorders in April 2008. The half of cost was sponsored by taxi insurance association and half by the taxi company. In Gyeong-gi Province, all company taxis and individual taxis (34,000) installed in-car accident recorders in March 2009. The half of cost was sponsored by Gyeong-gi province government, 4/10 of cost by the city & county government and 1/10 of cost by: the taxi company and individual taxi drivers.

3. BENEFIT FOR INSTALLING AN IN-CAR ACCIDENT RECORDER

When it comes to the qualitative effect, an in-car accident recorder could save repairing costs and insurance payments due to decrease of accidents. It could increase fuel efficiency due to safe driving. Besides, it could decrease negotiation and management cost for accidents and improve the commercial company image with the aim of safety.

As the qualitative effect, accidents and amounts of injury could be judged based on video images. False witness and insurance frauds could be prevented. AARS could solve troubles with passengers as a voice recorder. Handling process after accidents would be fast and effective through precise judgment on deciding who are victims or harmers. An in-car accident recorder could be used as a tool of education and emphasis of safety to drivers. The prejudice that taxi drivers are always harmers would be removed.

The table 2 shows the example of quantitative effect for a taxi company. Total amount of profit for five year is 431,620,000 won.

Table 2. Comparison of Benefit and Cost for installing AARS (A Taxi Company)

(units: 1,000 Korean WON)

	item	2008	2009	2010	2011	2012
Benefit	insurance fee	0	15,000	29,250	42,787	55,648
	decreasing fee for dealing accidents	26,500	26,500	26,500	26,500	26,500
	saving fuel	37,609	37,609	37,609	37,609	37,609
	total	64,109	79,109	93,359	106,896	119,757
	cumulative total	64,109	143,218	236,577	343,473	463,230
Cost	purchasing devices	18,810	0	0	0	0
	purchasing supplies	1,000	2,000	2,000	2,000	2,000

	maintenance	0	950	950	950	950
	total	19,810	2,950	2,950	2,950	2,950
	cumulative total	19,810	22,760	25,710	28,660	31,610
Profit	total	44,299	76,159	90,409	103,946	116,807
	cumulative total	44,299	120,458	210,867	314,813	431,620

Table 3 shows comparison of accident costs before and after installing in-car accident recorders. Total accident costs are decreased as 24,208,918 won for J company, 23,268,813 won for Y company, and 255,652,896 won for K company.

Table 3. Before/ After Comparison of Accident Costs (Taxi Companies)

company	year	Accident costs toward person (WON)	Accident costs toward objects (WON)	Total (WON)
J company (81 taxi)	2006	140,369,067	43,849,690	184,218,757
	2007	126,079,656	33,930,180	160,009,839
Y Company (77 taxi)	2006	94,255,263	18,368,200	112,623,463
	2007	70,179,040	10,175,610	89,354,650
K Company (79 taxi)	2006	341,142,683	48,920,800	390,063,483
	2007	106,153,717	28,256,870	134,410,587
2006. 5.1~2007. 2.28 (10 months)				

Table 4 and figure 1 illustrates rate of monthly accidents for every three months from 2006 to 2008 as an example of Taxi union in Incheon City. Average rate of accidents for three months is decreased from 63.4% in 2006 to 56.3% in 2008.

Table 4. Rate of Monthly Accidents for three months (Incheon City)

Year	Rate of monthly accidents (%)				Rate of increase (%)
	July	August	September	Average	
2006	70.2	60.1	63.6	63.4	-

2007	66.8	57.4	58.4	60.6	-2.8
2008	60.8	49.8	51.3	56.3	-4.3

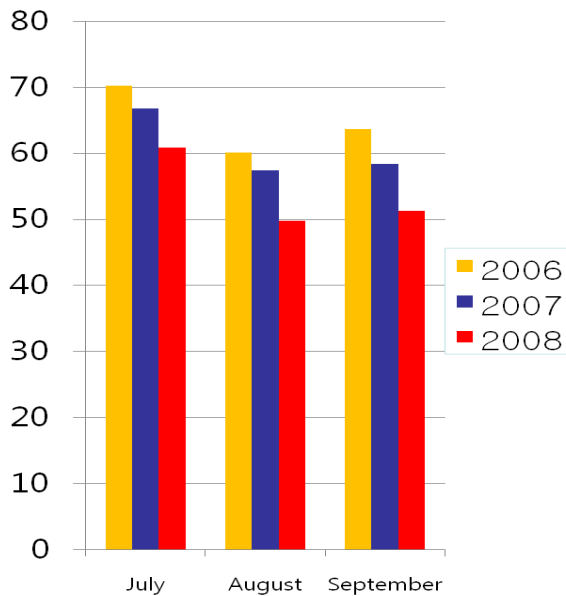


Figure 1. Rate of Monthly Accidents for three months (2006~2008, Incheon City)

As the quantitative effect, a D taxi company's case was analyzed. The company installed in-car accident recorders in 2007. The number of accidents toward person was decreased from 657 accidents in 2007 to 155 accidents in 2008. The number of accidents toward objects was decreased from 692 accidents in 2007 to 223 accidents in 2008. The rate of accidents toward person was decreased from 59.7% in 2007 to 22.8% in 2008. The rate of accidents toward objects was decreased from 58% in 2007 to 30.9% in 2008. The compensation money for accident toward person was decreased as much as 456,788,750 won (about 82%) from 555,150,330 won in 2007 to 98,361,580 won in 2008. The compensation money for accident toward objects was decreased as much as 49,352,460 won (about 67%) from 72,842,590 won in 2007 to 23,490,130 won in 2008.

Table 5. Number & Rate of Accidents toward Person (2007, a Taxi Company)

Period (2007)	Vehicles registered	Toward person					
		Total	Exemption	Damaging	Being damaged	Rate of accidents	Compensation money

						(%)	(WON)
Feb	178	27	0	25	2	91.01	17,651,940
Mar	178	36	0	30	6	80.90	12,763,470
April	178	40	2	32	6	64.04	8,818,100
May	178	45	3	34	8	56.63	41,286,980
June	178	49	3	36	10	51.69	13,873,020
July	178	58	3	43	12	52.97	14,676,100
Aug	178	69	3	52	14	55.62	15,650,240
Sep	178	71	3	53	15	50.94	44,301,560
Oct	178	83	3	63	17	53.93	36,987,380
Nov	178	87	5	65	17	50.26	58,465,530
Dec	178	92	5	68	19	48.88	290,676,010
Total							555,150,330

Table 6. Number & Rate of Accidents toward Objects (2007, a Taxi Company)

Period (2007)	Vehicles registered	Toward objects					
		Total	Exemption	Damaging	Being damaged	Rate of accidents (%)	Compensation money (WON)
Feb	178	22	0	18	4	74.16	5,448,000
Mar	178	28	0	20	8	64.92	2,674,000
April	178	38	2	26	10	60.67	2,778,300
May	178	47	2	32	13	60.67	6,003,400
June	178	53	3	37	13	56.18	9,725,000
July	178	63	5	44	14	55.86	10,533,000
Aug	178	73	5	54	14	57.30	3,828,500

Sep	178	76	6	55	15	52.43	10,568,300
Oct	178	89	7	66	16	55.28	2,171,000
Nov	178	99	8	73	18	55.77	9,490,000
Dec	178	104	9	78	17	53.37	9,623,090
Total							72,842,590

Table 7. Number & Rate of Accidents toward Person (2008, a Taxi Company)

Period (2008)	Vehicles registered	Toward person					
		Total	Exemption	Damaging	Being damaged	Rate of accidents (%)	Compensation money (WON)
Jan	178	3	0	2	1	20.22	7,539,270
Feb	168	5	0	4	1	17.86	43,364,310
Mar	162	7	0	6	1	17.28	3,764,820
April	162	11	0	7	4	20.37	9,025,410
May	162	16	1	9	6	22.22	4,119,590
June	162	23	1	15	7	27.16	7,263,530
July	162	27	1	18	8	27.51	1,019,000
August	162	31	1	21	9	27.78	13,157,720
Sep	162	32	1	22	9	25.51	9,107,930
Total							98,361,580
Amount of 2007							555,150,330
Amount of increase							-456,788,750 (-82%)

Table 8. Number & Rate of Accidents toward Objects (2008, a Taxi Company)

Period	Vehicles	Toward objects
--------	----------	----------------

(2008)	registered	Total	exemption	damaging	Being damaged	Rate of accidents (%)	Compensation money (WON)
Jan	178	4	0	3	1	26.97	3,221,000
Feb	168	7	1	5	1	21.43	751,000
Mar	162	12	1	9	2	27.16	1,232,000
April	162	21	2	14	5	35.18	4,343,000
May	162	25	3	17	5	32.59	654,000
June	162	31	3	22	6	34.57	1,534,000
July	162	34	4	23	7	31.75	4,308,000
August	162	43	5	28	10	35.19	1,740,000
Sep	162	46	5	31	10	33.74	5,707,130
Total							23,490,130
Amount of 2007							72,842,590
Amount of increase							-49,352,460 (-67%)

4. MAJOR ACCIDENT CASES INVESTIGATED BY AN IN-CAR ACCIDENT RECORDER

<Case 1>

The bus driver violating a traffic signal hit the taxi at a signalized intersection. The taxi driver and his passenger died. The bus driver lied the taxi driver violated a traffic signal because the taxi driver and his passenger died and there is not any witness. The in-car accident recorder in the taxi showed who disregarded a signal. If there were not an in-car accident recorder, the taxi company would pay 600million won in compensation

<Case 2>

The motorcycle driver violating a traffic signal hit the taxi at a signalized intersection. The passenger in the motorcycle insisted the taxi driver violated a traffic signal and

there is no witness. The in-car accident recorder in the taxi showed the motorcycle driver had violated. If there were not an in-car accident recorder, the taxi company would pay 500million won in compensation.

<Case 3>

A drunken passenger hit his head against the top of taxi. However, he insisted he was hurt because the taxi driver started while he was boarding. If there were not an in-car accident recorder, the taxi driver would pay 1.5~2.0million won in compensation. Voice recording function revealed the truth.

<Case 4>

The taxi driver hit the child jaywalking. However, the child insisted that he walked the pedestrian crossing. If there were not an in-car accident recorder, the taxi driver would pay 1.2 ~ 1.5million won in compensation.



Figure 2. Scene of an In-car Accident Recorder for Case 4

5. FEATURES OF IN-CAR ACCIDENT RECORDERS IN KOREA

Among current features of in-car accident recorders in Korea, not only first impact but also second and third impacts would be recorded. Through all-the-time recording a driver's behavior would be monitored. Sound in the car would be recorded because of voice recording function. GPS information (location, speed, time) would be obtained from AARS.



Figure 3. Analysis Scene of an In-car Accident Recorder

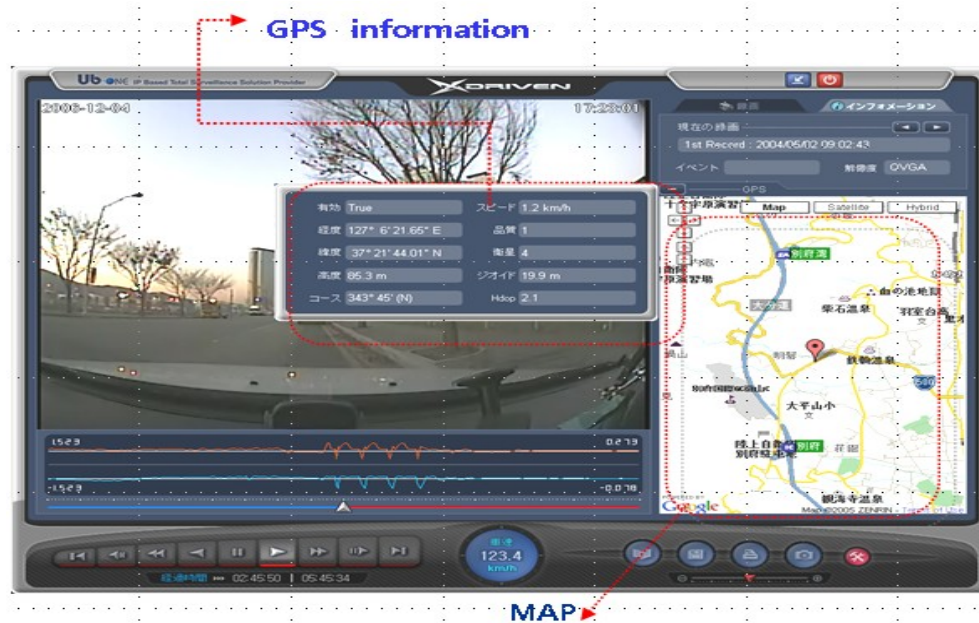








Figure 4. Analysis Scene of an In-car Accident Recorder

Table 9 compares the major specification of Korean products.

Table 9. Major Specification of Korean Products

	U company	H company	P company	W company	J company	K company
--	-----------	-----------	-----------	-----------	-----------	-----------

						
MODEL	DRS1100	MOVI	Road Scan	Witness II	ADR3000	Eaglezone
Recording device	SD memory card (8G Default)	Mini SD memory card (512M ~1G)	CF Flash	CF card 128MB	SD memory card (512MB~2GB)	SD memory card 1GB
Camera	CMOS 1.3 Mega Pixels	CMOS 310thousand Pixels	CMOS 310thousand Pixels	CCD 300thousand Pixels	CMOS	CMOS 1.3 Mega Pixels
Resolution	1280x960 Mega pixel 1.3 Mega Pixels	640 x 480	640 x 480 pixel 310thousand Pixels	640 x 480 pixel 300thousand Pixels	640 x 480 pixel	640 x 480 pixel 1.3 Mega Pixels
Recording time	Maximum 8 hours 400 events	10 frame / sec	8 frame / sec	7 frame / sec 9 events	16 frame /sec Maximum 90minutes	8 frame / sec
Angle of lens	156 °	120 °	120 °	107 °	170 °	158 °
Sensor	3D G-sensor	3D G-sensor	3D G-sensor	-	3D G-sensor	3D G-sensor
GPS	Yes	Yes	No	No	Yes	Yes

There is some weakness in Korean products. As external factors, there is shortage of capabilities in maintenance. Two channel of camera (outside and inside view) should be needed. AARS market is aftermarket not before-market. When it comes to internal factors, there are difficulties with stable power supply, installing in the middle of a car ,

and handling a power cable. When a serious accident occurs, it could be possible to be separated from the car.

6. CONCLUSIONS

To overcome the several weakness of Korean products, room-mirror type AARS is now under development. The in-car accident recorder is installed in a room mirror. Through room-mirror type AARS, it is expected that AARS market grows as before market.

The new AARS combining an in-car accident recorder with a digital tachometer is developing in 2009. All taxi in Korea must install the digital tachometer. It is expected that many taxi will install the new digital tachometer (in-car accident recorder + digital tachometer).

ACKNOWLEDGEMENT

This work is financially supported by Ministry of Land, Transport and Maritime Affairs (MLTM) through a research project "Integrated information system for management and auditing of road safety."